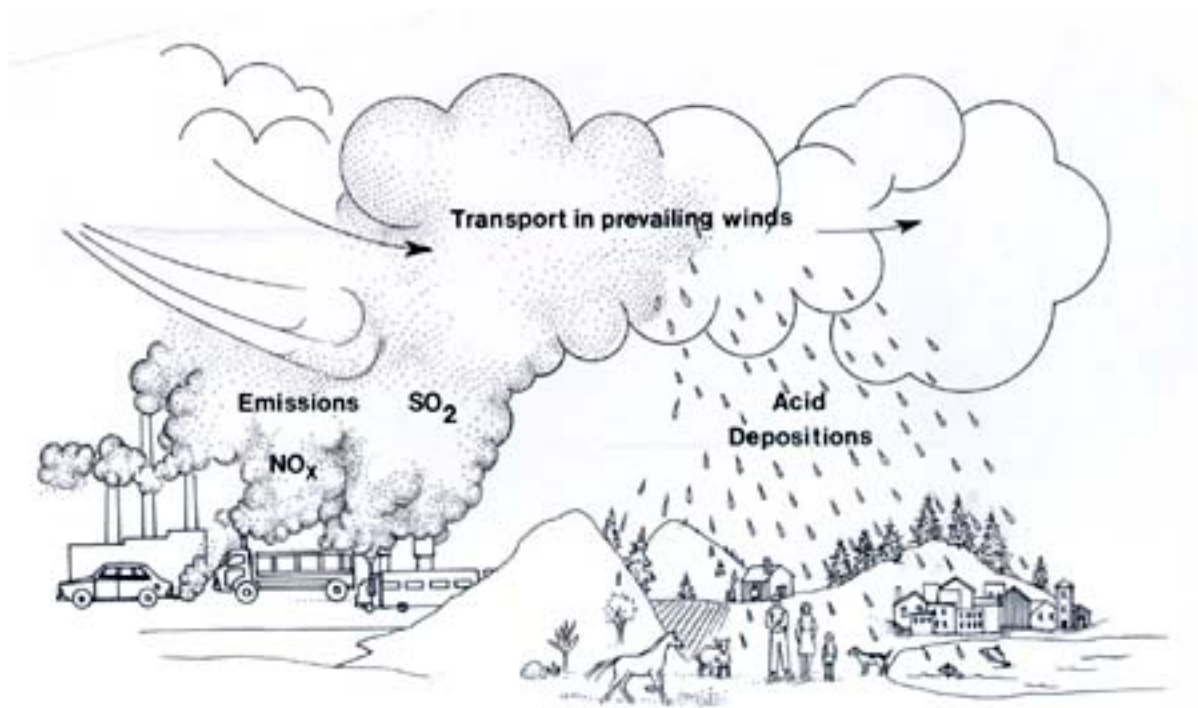


# 2003 Wisconsin *Sulfur Dioxide and Nitrogen Oxides Emissions Report*

---



*November 2005*

## **Natural Resources Board**

*Gerald M. O'Brien, Stevens Point, Chair*  
*Howard D. Poulson, Palmyra, Vice Chair*  
*Jonathan P. Ela, Madison, Secretary*  
*Herbert F. Behnke, Shawano*  
*Christine L. Thomas, Stevens Point*  
*John Welter, Eau Claire*  
*Stephen D. Willett, Phillips*

## **Wisconsin Department of Natural Resources**

*P. Scott Hassett, Secretary*  
*William H. Smith, Deputy Secretary*  
*Mary Schlaefter, Executive Assistant*

## **Division of Air & Waste Management**

*Allen K. Shea, Administrator*

## **Bureau of Air Management**

*Lloyd L. Eagan, Director*

## **Author**

*Timothy Dallmann, Environmental Engineering Student Intern, Bureau of Air Management*

## **Acknowledgments**

*I would like to thank the many DNR Bureau of Air Management staff who assisted me in this report. I would particularly like to thank John Meier and Roger Fritz for their time and effort.*

## Table of Contents

---

List of Appendices, Figures, and Tables.....	4
History.....	5
Effects of Sulfur Dioxide and Nitrogen Oxides.....	5
Acid Rain.....	5
Controlling Acid Rain.....	5
Wisconsin's Acid Rain Law.....	6
Source Categories	
Major Utility.....	6
Large Source.....	7
Small Source.....	7
Area Source.....	7
Federal Acid Rain Program.....	8
Sulfur Dioxide Reductions .....	8
Nitrogen Oxides Reductions .....	8
Data Summary.....	9
Sulfur Dioxide Emissions.....	9
Nitrogen Oxides Emissions.....	11
Quality Assurance of Data.....	13
Tables and Appendices.....	13

## **List of Appendices, Figures, and Tables**

### ***Sulfur Dioxide***

Table 1: WI Stationary Source Sulfur Dioxide Emissions Arranged by Category from 1980 to 2003.....	14
Table 2A: WI 2003 Major Utility Sulfur Dioxide Emissions Arranged by Facility.....	15
Table 2B: WI 2003 Large Source Sulfur Dioxide Emissions Arranged by Facility.....	16
Table 5: 2003 Corporate Average Annual Sulfur Dioxide Emission Rates.....	19
Figure 1: Sulfur Dioxide Emissions from 1980 to 2003.....	9
Figure 2: Sulfur Dioxide Emissions from Major Utilities from 1980 to 2003.....	10
Figure 3: Sulfur Dioxide Emissions from Large Sources from 1980 to 2003.....	10
Figure 4: 2003 Sulfur Dioxide Emissions per Source Category.....	11
Appendix A: Historical Listing of Sulfur Dioxide Emissions Arranged by Facility for 1999-2003.....	20
Appendix C: 2003 Sulfur Dioxide Emissions Rates for Major Utilities and One Large, State-Owned Source.....	23

### ***Nitrogen Oxides***

Table 3: WI Stationary Source Nitrogen Oxides Emissions Arranged by Category for 1980-2003.....	17
Table 4A: WI 2003 Major Utility Nitrogen Oxides Emissions Arranged by Facility....	18
Table 4B: WI 2003 Large Source Nitrogen Oxides Emissions Arranged by Facility....	19
Figure 5: Nitrogen Oxides Emissions from Major Utilities from 1980 to 2003.....	12
Figure 6: 2003 Nitrogen Oxides Emissions per Source Category.....	12
Appendix B: Historical Listing of Nitrogen Oxides Emissions Arranged by Facility for 1999-2003.....	22

## **History**

In 1986, Wisconsin enacted one of the first and strongest acid rain control laws in the nation. This law, found under sections 285.41 through 285.49, Wis. Stats., states the sulfur dioxide and nitrogen oxides emission rates and goals for Wisconsin. The 2003 Sulfur Dioxide and Nitrogen Oxides Report is the nineteenth annual report of its kind since 1980 required under s. 285.11(12), Wis. Stats., (air pollution control). This report compiles sulfur dioxide and nitrogen oxides emissions from Wisconsin's five major utilities, as well as large, small, and area sources, as defined below, and compares these emission rates to the limits and goals specified in s. 285.41 – 285.49, Wis. Stats..

## **Effects of Sulfur Dioxide and Nitrogen Oxides**

Sulfur dioxide and nitrogen oxides can cause many problems when released into the atmosphere. Children and the elderly are especially susceptible to the health effects of these pollutants which include lung tissue irritation, airway constriction, and decreased immune system efficiency. In addition to harmful health impacts, these pollutants can also cause negative environmental impacts. Both have been shown to contribute to acid rain and nitrogen oxides contribute to the production of ground level ozone.

## **Acid Rain**

In recent history, the acid rain phenomenon has brought destruction to thousands of lakes, streams, forests, and monuments in the United States, Canada, and parts of Europe. Sulfur dioxide and nitrogen oxide emissions are the main causes of acid rain. Coal-fired power plants along with pulp and paper mills are the main producers of sulfur dioxide emissions, while coal-fired power plants, factories, vehicles, and home furnaces are the most significant sources of nitrogen oxide emissions in Wisconsin. While in the air, these chemicals react with oxygen and moisture to form sulfuric, nitric and nitrous acid. These acids then return to land as precipitation in the form of rain, snow, or fog. Pollutant-free rain has a pH value of 5.0 to 6.0, on a scale where 14 is the least acidic, 0 the most acidic, and 7 neutral. The Wisconsin Department of Natural Resources considers rain to be acidic if it has a pH less than 5.0. In the early 1980s, pH values ranged from 4.4 in southeastern Wisconsin to 4.8 in northwestern Wisconsin. The acid rain control law helped to improve that range by 2003 to 4.8 in the southeast and 5.3 in the northwest. A pH goal of 4.7 or greater is established in the state law.

## **Controlling Acid Rain**

Controlling acid rain is directly related to managing the combustion of fossil fuels. The byproducts of fuel combustion contain large amounts of nitrogen oxides which are emitted into the atmosphere and produce acid rain. The same is true for fuels that contain sulfur (such as coal and fuel oils) which emit sulfur dioxide when combusted. According

to the 2004 Wisconsin Energy Statistics published by the Department of Administration's Wisconsin Energy Bureau, 82 percent of the energy resources that Wisconsin consumed in 2003 were fossil fuel resources. Coal comprised 31 percent of the energy resources consumed in 2003, while petroleum and natural gas comprised 29 percent and 22 percent, respectively.

It is obvious that one way to control acid rain is to reduce the amount of sulfur dioxide and nitrogen oxides emitted into the atmosphere. This can best be accomplished by decreasing the use of fossil fuels used in utilities and increasing the use of alternative energy resources such as solar, wind, hydroelectric, and nuclear. During 2003 nuclear energy consumption accounted for only 7 percent of the total energy resources consumed in Wisconsin and renewable energy resources accounted for a mere 4 percent.

Another way to control acid rain is through energy conservation. Reductions in fossil fuel combustion are directly correlated to reductions in energy demand. Energy conservation is voluntary; therefore, this method of reducing sulfur dioxide and nitrogen oxide emissions could be effective only if participation is high. Combustion related alternatives that can be implemented at major utilities include switching to low-sulfur coal and/or low-sulfur petroleum products. Emission reductions at other sources can be accomplished by using more fuel-efficient vehicles or electric hybrid vehicles, and replacing old home furnaces with newer, more efficient furnaces. Major utilities in Wisconsin have now switched to low-sulfur coal in order to comply with acid rain laws. In the future, cars powered by fuel cells, electricity, or alternative fuels may also contribute to controlling acid rain.

## **Wisconsin's Acid Rain Law**

The state's acid rain control law was enacted in April of 1986. In addition to striving for a precipitation pH level above 4.7 throughout the state, standards for nitrogen oxides and sulfur dioxide emissions were created for each type of source. The primary goal is to reduce sulfur dioxide emissions to 50 percent of 1980 levels. A definition of each source and the emission limits and goals that affect those source types is as follows:

### ***Major Utility***

Under the acid rain law, a major utility is defined as any electric utility or electrical cooperative with \$2.5 million or more in annual gross operating revenues that has sulfur dioxide emissions of 5000 tons or more in any year after 1979 from all stationary sources in Wisconsin.

Wisconsin has five major utilities:

- Alliant Energy (formerly Wisconsin Power & Light)
- Dairyland Power Cooperative
- Madison Gas and Electric Company
- Wisconsin Electric Power Company (WE Energies)
- Wisconsin Public Service Corporation

Three goals, two for sulfur dioxide and one for nitrogen oxides emissions, are established for major utilities under the acid rain control law. Effective January 1, 1993, each major utility must limit their annual average sulfur dioxide emissions to 1.20 pounds of sulfur dioxide per million British thermal units (mmBtu) of heat input generated from fossil fuel-fired boilers located in Wisconsin. Also effective January 1, 1993, the total annual sulfur dioxide emissions from all major utilities are not to exceed 250,000 tons in any year. After 1991, the goal for nitrogen oxide emissions from all major utilities is not to exceed 135,000 total tons per year.

### ***Large Source***

A large source is defined in the acid rain law as any stationary source in Wisconsin, other than a fossil fuel-fired boiler under ownership or control of a major utility that has an annual five-year sulfur dioxide emissions average of 1,000 tons or more for the most recent five-year period. The large source had to be operational before May 2, 1986, and boilers subject to the new stationary sources standard of performance (NSPS) for sulfur dioxide emissions established under s. 285.27(1), Wis. Stats. are excluded. Wisconsin's acid rain law does not specifically define large sources of nitrogen oxides. For this report, a large nitrogen oxides emission source is defined as any source other than a fossil fuel-fired boiler under the ownership or control of a major utility that emitted 1,000 tons or more nitrogen oxides in the current year.

The acid rain law established the goal for all large sources in Wisconsin not to exceed 75,000 tons of sulfur dioxide emissions per year. For state-owned large sources, the law also set a goal of not exceeding an average of 1.50 pounds of sulfur dioxide per mmBtu heat input per year for each source.

### ***Small Source***

Small sources consist of all of the stationary sulfur dioxide or nitrogen oxides emission sources listed in the Wisconsin Air Emissions Inventory maintained by the Department of Natural Resources that are neither large sources nor major utilities. In terms of emissions, small sources emit on average for the most recent five-year period less than 1000 tons of sulfur dioxide emissions and less than 1000 tons of nitrogen oxides emissions for any year.

### ***Area Source***

Sources that are too small or too difficult to be surveyed individually, such as home furnaces and automobiles, are classified as area sources. They are called area sources because their emissions are totaled and reported collectively for geographic areas such as cities, counties, or states. The Department of Natural Resources does not routinely determine area source emissions. Area source sulfur dioxide and nitrogen oxides emissions from 1980 were estimated in the Wisconsin Acid Deposition Emission Inventory, which was produced as part of the Wisconsin Cooperative Acid Deposition Research Program. That estimate has been used to approximate 1980 to 2003 area source emissions for this report.

## **Federal Acid Rain Program**

In 1990 Title IV of the Clean Air Act was set into law with primary goals of reducing sulfur dioxide emissions to 10 million tons below 1980 levels and nitrogen oxides emissions to 2 million tons below 1980 levels.

### ***Sulfur Dioxide Reductions***

The law provided a two-phase tightening of restrictions placed on fossil fuel-fired boilers is required to achieve the desired goal for sulfur dioxide emissions. With a total of 445 units affected, Phase I began in 1995 with an initial 263 units at 110 mostly coal-burning electric utility plants located in 21 eastern and midwestern states. An additional 182 units joined Phase I as substitution or compensating units, which creates 445 total units affected by Phase I. Phase II began January 1, 2000 and capped the combined sulfur dioxide emissions generated at 8.95 million tons per year for Phase I affected units and other electric utility units serving generators over 25 MW. The Federal Acid Rain Program grants sulfur dioxide emission “allowances” to facilities based on a facility’s average heat input (in mmBtu) for 1985 through 1987. Facilities affected by Phase I are allocated allowances equivalent to 2.50 pounds of sulfur dioxide per mmBtu. The number of sulfur dioxide allowances allocated drops to 1.20 pounds per mmBtu during Phase II. Each affected source must have enough allowances to cover its sulfur dioxide emissions in a given year.

Wisconsin has 13 utility units affected by Phase I and approximately 70 utility units affected by Phase II. The 5 major utilities in Wisconsin are required by the Wisconsin acid rain control law to limit sulfur dioxide emissions to 1.20 pounds per mmBtu and 1.50 pounds per mmBtu for state owned facilities since 1993. For Phase I, Wisconsin utilities have met the required 2.50 pounds per mmBtu limit. In 2003 Wisconsin major utilities met Phase II emission limits as well.

### ***Nitrogen Oxides Reductions***

In 1997, the beginning of Phase I, the nitrogen oxides reduction program established nitrogen oxides limitations for dry bottom wall-fired boilers and tangentially fired boilers. The annual limitations set are 0.50 pounds of nitrogen oxides per mmBtu for dry bottom wall-fired boilers, and 0.45 pounds of nitrogen oxides per mmBtu for tangentially fired boilers. Beginning in 2000, the Phase II program enacted new nitrogen oxides emission limitations for dry bottom wall-fired and tangentially fired boilers and it also established limits for other types of boilers.

For more information on the federal acid rain program, see the EPA’s Acid Rain Program Home Page:

<http://www.epa.gov/acidrain>

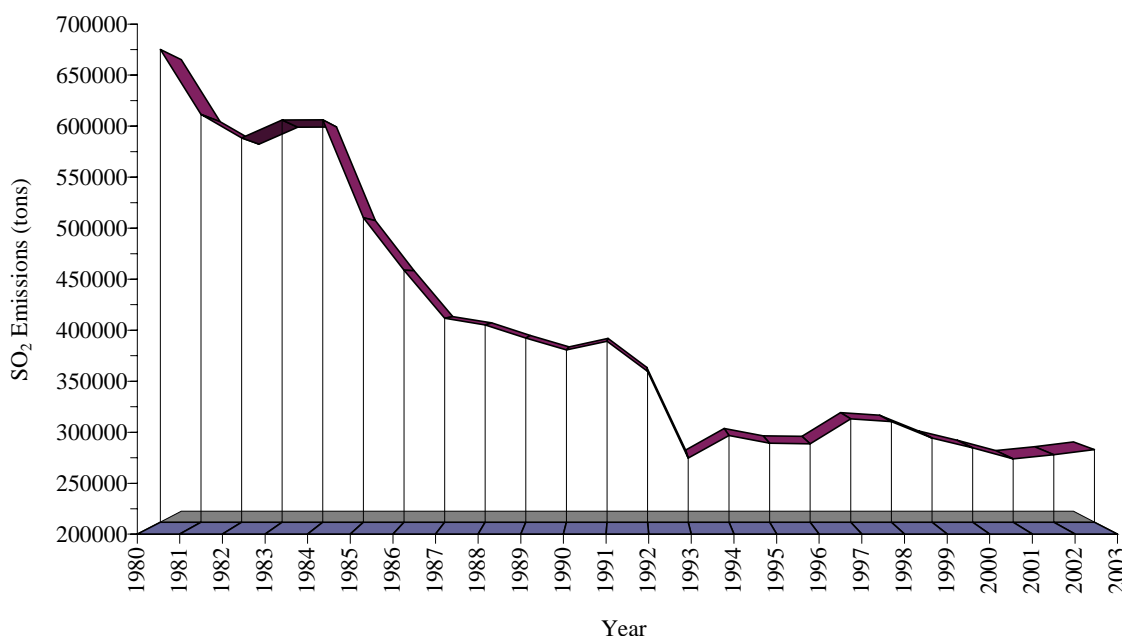


## **Data Summary**

### ***Sulfur Dioxide Emissions***

Wisconsin stationary sources emitted 274,647 tons of sulfur dioxide in 2003. These emissions are down 60 percent from the 1980 level of 686,399 tons. Figure 1 represents Wisconsin's sulfur dioxide emissions for the time period of 1980 to 2003.

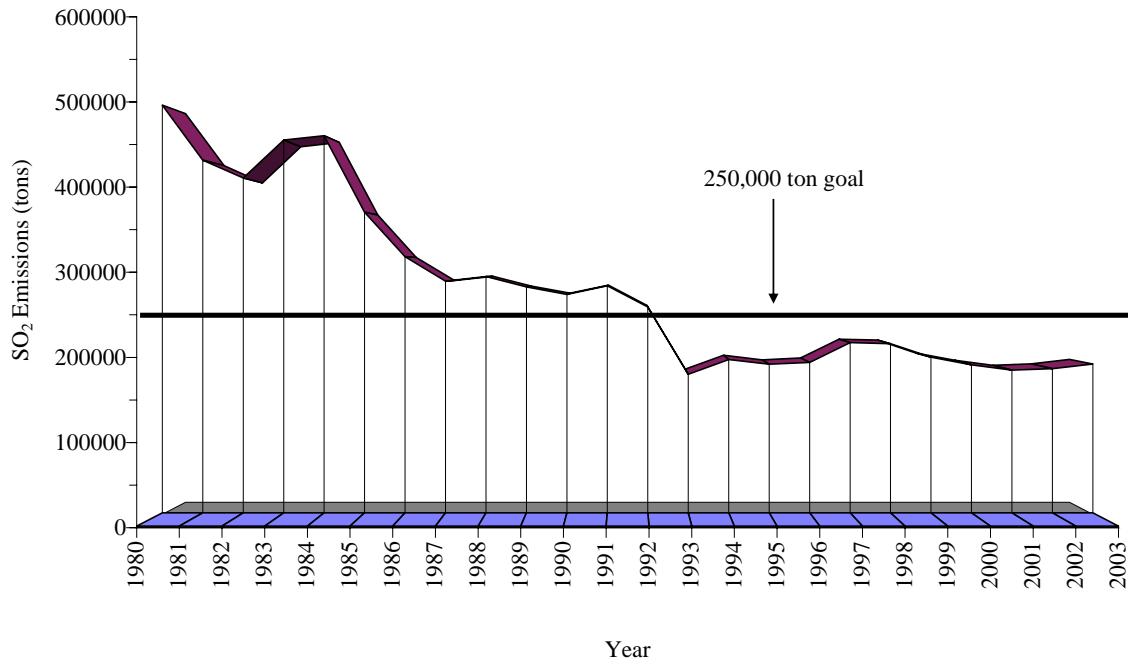
**Sulfur Dioxide Emissions from 1980 to 2003**



**Figure 1. Time history of Wisconsin's sulfur dioxide emissions per year.**

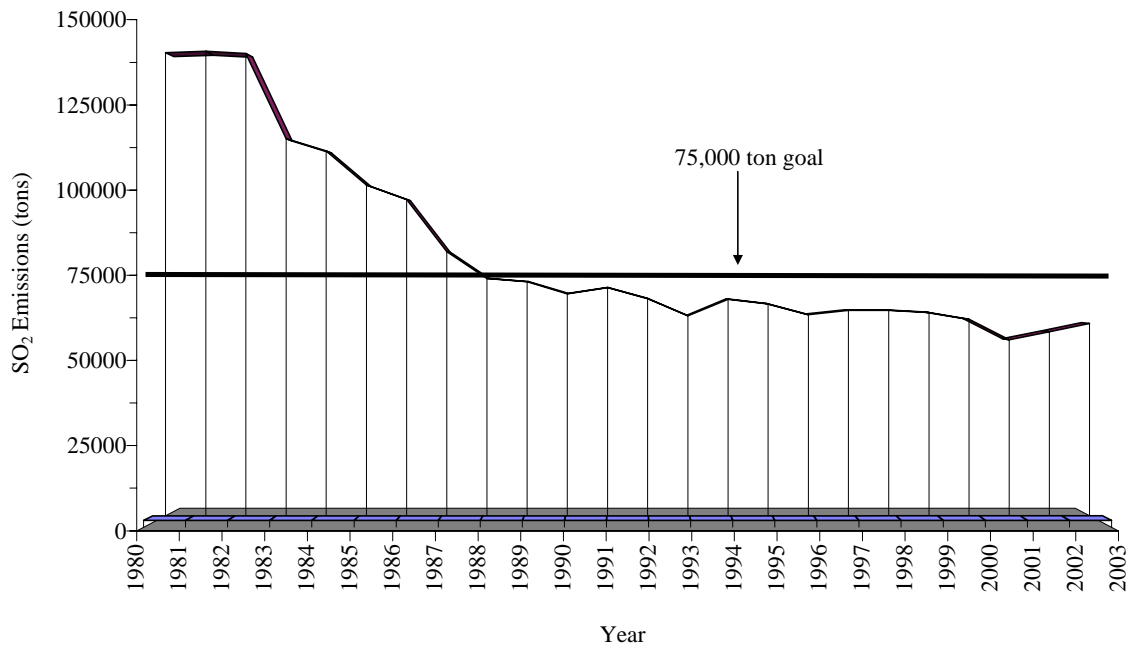
Major utilities alone reduced sulfur dioxide emissions from 506,954 tons in 1980 to 186,246 tons in 2003, a reduction of 63 percent below 1980 levels. Large sources reduced emissions from 144,439 tons in 1980 to 59,971 tons in 2003, a 58 percent reduction, and paper mills alone (a subset of large sources) reduced emissions from 127,339 tons in 1980 to 53,797 tons in 2003, also a 58 percent reduction. The total major utility emissions for 2003 are 63,754 tons below the annual goal of 250,000 tons established in Wisconsin's acid rain control law. Large source emissions in 2003 are 15,029 tons below the annual goal of 75,000 tons. Figures 2 and 3 represent sulfur dioxide emissions from Wisconsin's major utilities and large sources in reference to their emission goals.

### Sulfur Dioxide Emissions from Major Utilities from 1980 to 2003



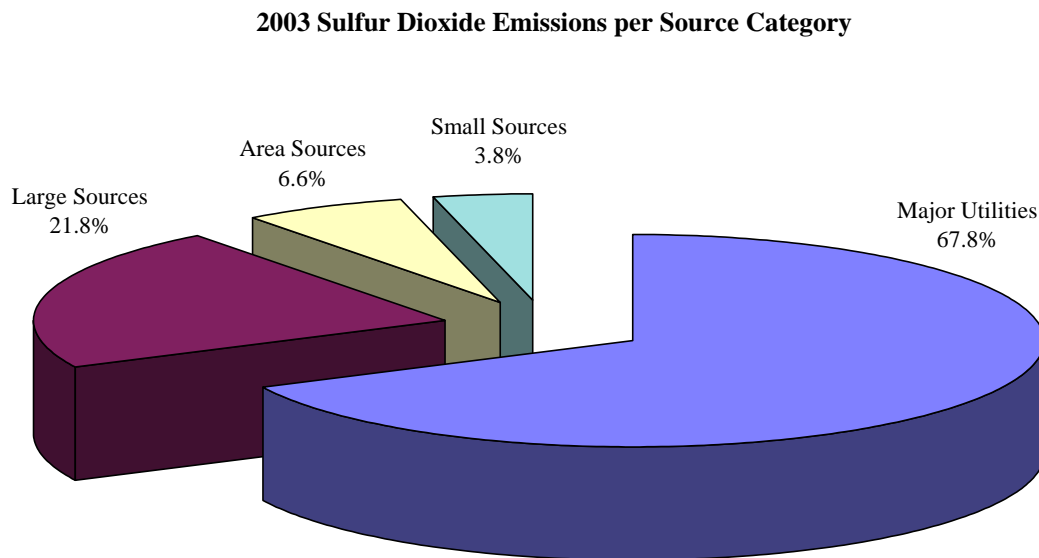
**Figure 2. Time history for major utilities' sulfur dioxide emissions in Wisconsin.**

### Sulfur Dioxide Emissions from Large Sources from 1980 to 2003



**Figure 3. Time history for large sources' sulfur dioxide emissions in Wisconsin.**

Major utilities account for 67.8 percent of total stationary source sulfur dioxide emissions in 2003. Large sources account for 21.8 percent, 19.6 percent from paper mills alone. Collectively, 89.6 percent of the sulfur dioxide emissions originated from major utilities and large sources. The remaining 10.4 percent originated from area and small sources. Figure 4 represents the contribution of each source towards Wisconsin's total stationary source sulfur dioxide emissions.



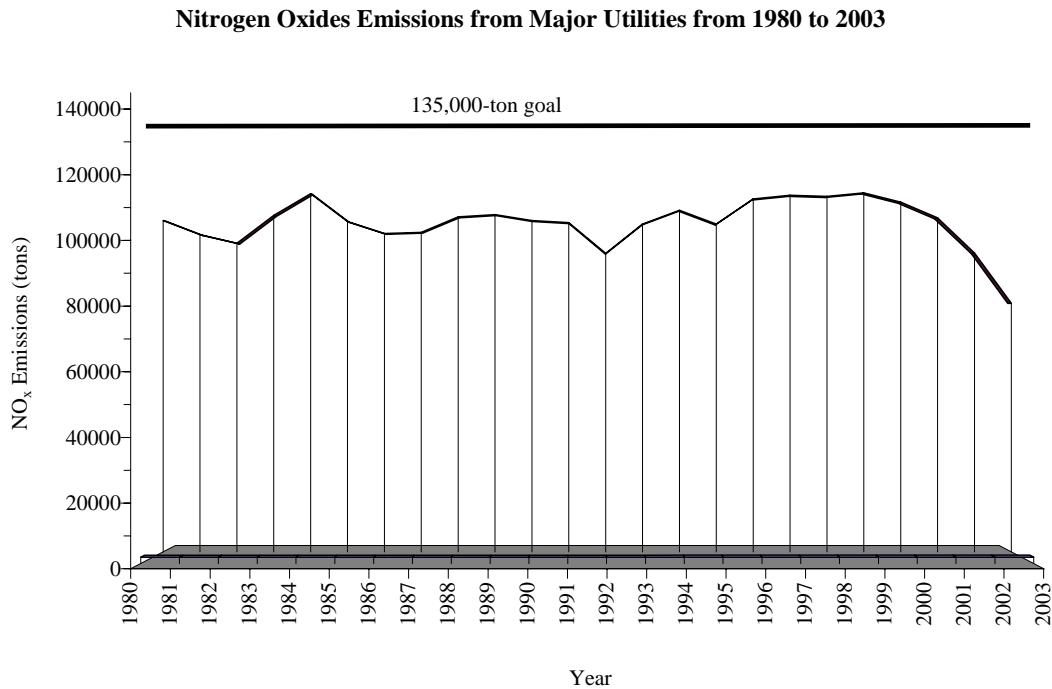
**Figure 4. Breakdown of Wisconsin's 2003 sulfur dioxide emissions by source category.**

In 2003, all of the five major utilities of Wisconsin have sulfur dioxide emission rates below the 1.20 pounds of sulfur dioxide per mmBtu of energy input established in the Federal acid rain program. Wisconsin's one large, state-owned source, the University of Wisconsin-Madison Charter Street, also has a sulfur dioxide emission rate below the standard of 1.50 pounds of sulfur dioxide per mmBtu of energy input required in Wisconsin's acid rain control law for state owned facilities.

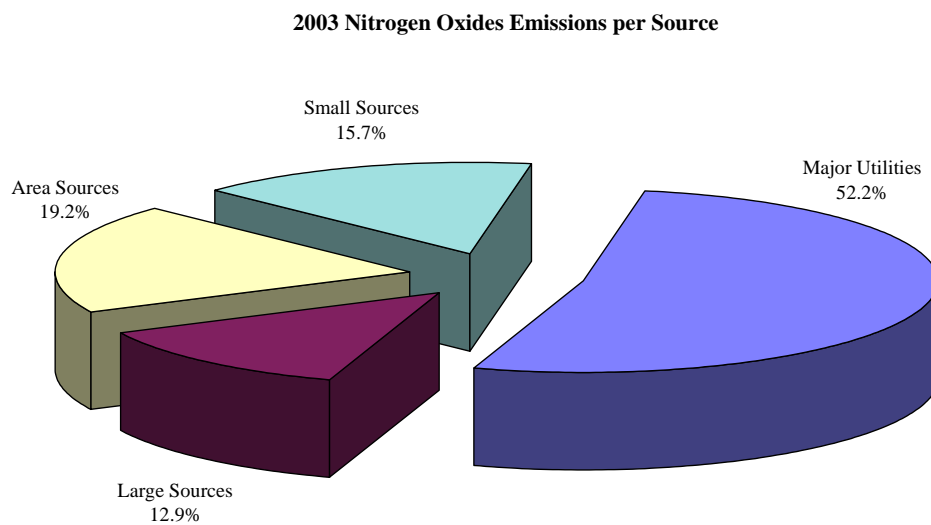
### ***Nitrogen Oxides Emissions***

Stationary sources emitted a total of 156,186 tons of nitrogen oxides in 2003. The 2003 nitrogen oxides emissions are 16 percent below the 1980 nitrogen oxides emission levels. Between 1980 and 2003, major utilities decreased nitrogen oxides emissions by 25 percent (from 108,606 to 81,503 tons). Nitrogen oxides emissions from the major utilities have remained below the 135,000-ton goal set in Wisconsin's acid rain control law. Figure 5 represents the emissions from the major utilities from 1980 to 2003. Large sources emitted 20,199 tons of nitrogen oxides in 2003, a 18 percent reduction from 1980 levels.

Major utilities account for 52.2 percent of the total stationary source nitrogen oxides emissions. Collectively, major utilities and large sources account for 65.1 percent of nitrogen oxides emissions. The remaining 34.9 percent originated from area and small sources. Figure 6 below represents the contribution of each source towards Wisconsin's total stationary source nitrogen oxides emissions.



**Figure 5. Time history for major utilities' nitrogen oxides emissions in Wisconsin.**



**Figure 6. Breakdown of Wisconsin's 2003 nitrogen oxides emissions by source category.**

## **Quality Assurance of Data**

The data presented in this report for stationary point sources was derived primarily from two sources: the 2003 Air Emissions Inventory File and the 2003 sulfur dioxide emission summaries that Wisconsin's major utilities submit for the acid rain control law. The area source estimate was derived from the Wisconsin Acid Deposition Emission Inventory.

Sources submitting information to the emission inventory certify the information submitted is accurate. In addition, the DNR regional staff reviewed the data for accuracy. Federal and state acid rain laws often require continuous emission monitoring of sulfur dioxide and nitrogen oxides for large sources, so the measurement and reporting of these emissions should be accurate.

The corporate averages were determined from the 2003 sulfur dioxide emission summaries submitted by the major utilities. Please note that some power plant boilers are owned by more than one major utility. Jointly owned facilities have emissions credited to the appropriate utility on the basis of the energy generated for that utility. Only utility-operated boiler units were considered in determining the annual average emission rates.

## **Tables and Appendices**

The following tables and appendices were created from major utility emissions data sheets submitted by the utilities and data obtained from the 2003 Air Emissions Inventory File. The tables and appendices provide historical information about Wisconsin's sulfur dioxide and nitrogen oxides emissions since 1980.

**Table 1: Wisconsin Stationary Source Sulfur Dioxide Emissions Arranged by Category  
from 1980 to 2003**

Values listed in tons of sulfur dioxide emitted

Year	Major Utilities			Large Sources				Area Sources	Small Sources	Total Emissions
	Pre-NSPS	NSPS	Total	Minor Utilities	Paper Mills	Other Facilities	Total			
1980	483,280	23,674	506,954	6,668	127,339	10,432	144,439	18,000	17,006	686,399
1981	409,320	29,527	438,847	7,360	122,363	15,124	144,847	18,000	17,868	619,562
1982	386,410	30,264	416,674	6,746	119,301	18,150	144,197	18,000	16,448	595,319
1983	425,814	37,859	463,673	4,526	99,729	13,370	117,625	18,000	14,475	613,773
1984	435,515	33,726	469,241	4,966	97,540	11,277	113,783	18,000	12,892	613,916
1985	334,732	39,668	374,400	5,525	87,464	10,147	103,136	18,000	17,526	513,062
1986	269,682	49,519	319,201	4,726	85,396	8,542	98,664	18,000	23,313	459,178
1987	230,882	58,209	289,091	2,490	70,658	9,204	82,352	18,000	20,234	409,677
1988	242,831	51,950	294,781	3,111	62,059	8,837	74,007	18,000	16,135	402,923
1989	222,739	59,027	281,766	2,879	61,955	8,129	72,963	18,000	16,706	389,435
1990	210,078	62,514	272,592	1,866	60,500	6,868	69,234	18,000	17,214	377,040
1991	220,487	62,798	283,285	3,284	57,521	10,370	71,175	18,000	13,712	386,172
1992	196,694	60,249	256,943	1,985	57,140	8,552	67,677	18,000	12,470	355,090
1993	116,814	56,776	173,590	2,280	53,923	6,125	62,328	18,000	11,954	265,872
1994	120,989	70,728	191,717	2,565	60,386	4,547	67,498	18,000	11,833	289,048
1995	116,236	69,654	185,890	2,267	59,525	4,245	66,037	18,000	11,270	281,197
1996	122,395	65,723	188,118	1,771	56,967	3,974	62,712	18,000	11,804	280,634
1997	142,484	70,180	212,665	1,877	58,033	4,140	64,050	18,000	11,468	306,183
1998	143,446	68,076	211,522	3,980	55,853	4,216	64,049	18,000	9,830	303,401
1999	122,938	71,870	194,808	2,770	56,717	3,866	63,353	18,000	10,368	286,528
2000	120,754	64,473	185,227	3,282	54,258	3,720	61,260	18,000	12,002	276,489
2001	112,839	65,969	178,808	3,052	47,988	3,828	54,868	18,000	13,472	265,148
2002	113,771	66,715	180,487	3,750	50,629	3,006	57,385	18,000	9,200	269,343
2003	116,593	69,653	186,246	3,304	53,797	2,870	59,971	18,000	10,430	274,647
% Change from 1980 Levels			-63%					-58%	-39%	-60%

**Table 2A: Wisconsin 2003 Major Utility Sulfur Dioxide Emissions Arranged By Facility**

Facility Name	Location	SO <sub>2</sub> Emissions (tons)	Percent of Total SO <sub>2</sub> Emissions
<b><u>Pre-NSPS</u></b>			
Alliant (WP&L), Blackhawk	Beloit	0	42.5%
Alliant (WP&L), Columbia 1	Portage	15,666	
Alliant (WP&L), Edgewater 3&4	Sheboygan	8,511	
Alliant (WP&L), Nelson Dewey	Cassville	14,554	
Alliant (WP&L), Rock River	Beloit	11	
Alliant (WP&L), Sheepskin	Edgerton	0	
Dairyland Power Alma 1-5	Alma	9,386	
Dairyland Power, Genoa	Genoa	16,844	
Madison Gas & Electric, Blount	Madison	6,494	
Madison Gas & Electric, Fitchburg	Fitchburg	0	
Madison Gas & Electric, Nine Springs	Madison	0	
Madison Gas & Electric, Sycamore	Madison	0	
WEPCO, Germantown	Germantown	3	
WEPCO, Oak Creek	Oak Creek	13,294	
WEPCO, Point Beach	Two Rivers	0	
WEPCO, Port Washington	Port Washington	9,062	
WEPCO, Valley	Milwaukee	11,537	
WPSC, Eagle River	Eagle River	1	
WPSC, Pulliam Plant	Green Bay	7,081	
WPSC, Weston 1&2	Weston	4,149	
	<b>Subtotal</b>	<b>116,593</b>	
<b><u>NSPS</u></b>			
Alliant (WP&L), Columbia 2	Portage	14,554	25.4%
Alliant (WP&L), Edgewater 5	Sheboygan	10,039	
Dairyland Power, J.P. Madgett	Alma	5,777	
WEPCO, Pleasant Prairie	Kenosha	30,334	
WPSC, Peshtigo	Peshtigo	1	
WPSC, Weston 3	Weston	8,948	
	<b>Subtotal</b>	<b>69,653</b>	
<b>Total</b>		<b>186,246</b>	
<b>Total for All Stationary Sources</b>		<b>274,647</b>	

**Table 2B: Wisconsin 2003 Large Source Sulfur Dioxide Emissions Arranged by Facility**

Facility Name	Location	SO <sub>2</sub> Emissions (tons)	Percent of Total SO <sub>2</sub> Emissions
<b><u>Minor Utilities</u></b>			
Manitowoc Public Utilities	Manitowoc	3,304	1.2%
	Subtotal	3,304	
<b><u>Pulp and Paper Mills</u></b>			
Appleton Coated, LLC <sup>1</sup>	Combined Locks	1,130	19.6%
Domtar A. W. Corporation-Nekoosa Mill <sup>2</sup>	Nekoosa	4,238	
Domtar A. W. Corporation-Port Edwards Mill <sup>3</sup>	Port Edwards	2,392	
Stora Enso N. America-Biron Mill	Biron	5,519	
Stora Enso N. America-Kimberly Mill <sup>4</sup>	Kimberly	2,020	
Stora Enso N. America-Niagara Mill	Niagara	1,964	
Stora Enso N. America-Wis Rapids Pulp Mill	Wisconsin Rapids	1,520	
Fort James Operating Company	Green Bay	14,124	
International Paper	Kaukauna	8,740	
Packaging Corporation of America <sup>5</sup>	Tomahawk	6,596	
Mosinee Paper Corp.	Mosinee	1,567	
Wausau-Mosinee Paper Co.-Rhinelander	Rhinelander	2,254	
Procter & Gamble Paper Products Company	Green Bay	1733	
	Subtotal	53,797	
<b><u>Other Large Sources</u></b>			
Murphy Oil USA, Inc.	Superior	1,021	1.0%
University of Wisconsin - Charter St.	Madison	1,849	
	Subtotal	2,870	
Total		59,971	21.8%
Total for All Stationary Sources		274,647	

1. Previously Combined Locks Energy Center, LLC

2. Previously Nekoosa Papers, Inc.

3. Previously Nekoosa Papers, Inc.

4. Previously Inter Lake Papers

5. Previously Tenneco Packaging, Inc.



**Table 3: Wisconsin Stationary Source Nitrogen Oxides Emissions Arranged by Category from 1980-2003**

Values listed in tons of nitrogen oxides emitted

Year	Major Utilities			Large Sources	Area Sources	Small Sources	Total Emissions
	Pre-NSPS	NSPS	Total				
1980	94,354	14,252	108,606	24,715	30,000	23,462	186,783
1981	85,038	18,955	103,993	-	30,000	-	-
1982	83,041	18,110	101,151	-	30,000	-	-
1983	87,661	22,651	110,312	-	30,000	-	-
1984	93,530	23,921	117,451	-	30,000	-	-
1985	80,996	27,305	108,301	20,236	30,000	21,786	180,323
1986	73,815	30,588	104,403	18,286	30,000	22,466	175,155
1987	70,696	34,049	104,745	18,579	30,000	21,480	174,804
1988	77,175	32,640	109,815	18,763	30,000	22,788	181,366
1989	74,852	35,706	110,558	18,984	30,000	22,857	182,399
1990	70,978	37,653	108,631	19,029	30,000	23,300	180,960
1991	69,629	38,345	107,974	17,822	30,000	23,079	178,875
1992	64,943	32,873	97,816	31,731	30,000	21,595	181,142
1993	72,641	34,848	107,489	20,202	30,000	21,299	178,990
1994	75,524	36,450	111,974	22,507	30,000	21,182	185,663
1995	71,279	36,178	107,457	22,531	30,000	22,811	182,799
1996	78,723	36,995	115,718	18,627	30,000	27,671	192,016
1997	77,805	39,113	116,918	22,744	30,000	28,131	197,793
1998	77,948	38,590	116,538	24,764	30,000	22,493	193,795
1999	77,724	39,990	117,714	21,124	30,000	22,350	191,188
2000	77,666	36,978	114,644	21,348	30,000	23,023	189,016
2001	71,327	38,148	109,475	20,714	30,000	24,603	184,792
2002	62,828	35,144	97,972	21,110	30,000	20,126	169,208
2003	45,962	35,541	81,503	20,199	30,000	24,484	156,186
% Change from 1980 Levels			-25%	-18%		4%	-16%

- Emissions were not totaled for this source category in that year.

**Table 4A: Wisconsin 2003 Major Utility Nitrogen Oxides Emissions Arranged by Facility**

Facility Name	Location	NO <sub>x</sub> Emissions (tons)	Percent of Total NO <sub>x</sub> Emissions
<b>Pre-NSPS</b>			
Alliant (WP&L), Blackhawk	Beloit	50	
Alliant (WP&L), Columbia 1	Portage	2,996	
Alliant (WP&L), Edgewater 3&4	Sheboygan	5,421	
Alliant (WP&L), Nelson Dewey	Cassville	4,281	
Alliant (WP&L), Rock River	Beloit	741	
Alliant (WP&L), Sheepskin	Edgerton	4	
Dairyland Power, Alma 1-5	Alma	3,747	
Dairyland Power, Genoa	Genoa	4,429	
Madison Gas & Electric, Blount	Madison	1,460	
Madison Gas & Electric, Fitchburg	Fitchburg	28	
Madison Gas & Electric, Nine Springs	Madison	1	
Madison Gas & Electric, Sycamore	Madison	17	
WEPCO, Germantown	Germantown	108	
WEPCO, Oak Creek	Oak Creek	5,016	
WEPCO, Point Beach	Two Rivers	2	
WEPCO, Port Washington	Port Washington	2,292	
WEPCO, Valley	Milwaukee	3,093	
WEPCO, Watertown	Watertown	93	
WPSC, Eagle River	Eagle River	13	
WPSC, Pulliam Plant	Green Bay	8,424	
WPSC, Weston 1&2	Weston	3,746	
	<b>Subtotal</b>	<b>45,962</b>	<b>29.4%</b>
<b>NSPS</b>			
Alliant (WP&L), Columbia 2	Portage	7,198	
Alliant (WP&L), Edgewater 5	Sheboygan	3,145	
Dairyland Power, J.P. Madgett	Alma	4,484	
WEPCO, Paris	Paris	185	
WEPCO, Pleasant Prairie	Kenosha	16,950	
WPSC	Peshtigo	168	
WPSC, Weston 3	Weston	3,411	
	<b>Subtotal</b>	<b>35,541</b>	<b>22.8%</b>
	<b>Total</b>	<b>81,503</b>	<b>52.2%</b>
<b>Total for All Stationary Sources</b>		<b>156,186</b>	

**Table 4B: Wisconsin 2003 Large Source Nitrogen Oxides Emissions Arranged by Facility**

Facility Name	Location	NO <sub>x</sub> Emissions (tons)	Percent of Total NO <sub>x</sub> Emissions
ANR Pipeline Co.	Marshfield	1,410	12.9%
Cardinal FG	Menomonie	1,284	
Cardinal FG	Portage	1,421	
Domtar A. W. Corporation-Nekoosa Mill <sup>1</sup>	Nekoosa	1,386	
Stora Enso N. America-Biron Mill	Biron	2,142	
Stora Enso N. America-Wis. Rapids Pulp Mill	Wisconsin Rapids	1,875	
Fort James Operating Co.	Green Bay	4,012	
International Paper	Kaukauna	2,146	
Xcel Energy Bay Front Generating Station <sup>3</sup>	Ashland	1,346	
Packaging Corporation of America <sup>2</sup>	Tomahawk	1,591	
Wausau-Mosinee Paper Co-Rhineland	Rhineland	1,586	
	<b>Total</b>	<b>20,199</b>	
<b>Total for All Stationary Sources</b>		<b>156,186</b>	

1. Previously Nekoosa Papers, Inc.

2. Previously Tenneco Packaging, Inc.

3. Previously Northern States Power Co.

**Table 5: 2003 Corporate Average Annual Sulfur Dioxide Emission Rates**

<b>Major Utilities</b>	<b>Average SO<sub>2</sub> Rates (LB/MMBTU)</b>
Alliant Energy Corp. (WP&L)	0.86
Dairyland Power Cooperative	1.10
Madison Gas & Electric	1.06
Wisconsin Electric Power Co.	0.73
Wisconsin Public Service Corp.	0.60
<b>Large Sources, State-Owned</b>	
University of Wisconsin-Madison - Charter St.	0.92

**Appendix A: Historical Listing of Sulfur Dioxide Emissions Arranged by Facility for 1999-2003**

Facility Name	Location	SO <sub>2</sub> Emissions (tons)					Five Year Average (1999-2003)
		1999	2000	Year 2001	2002	2003	
Pre-NSPS Major Utilities							
Alliant (WP&L), Blackhawk	Beloit	0	0	0	0	0	0
Alliant (WP&L), Columbia 1	Portage	14,140	15,056	13,769	14,013	15,666	14,529
Alliant (WP&L), Edgewater 3 & 4	Sheboygan	7,980	8,962	8,656	7,790	8,511	8,380
Alliant (WP&L), Nelson Dewey	Cassville	13,281	14,275	11,323	15,709	14,554	13,828
Alliant (WP&L), Rock River	Beloit	1,397	24	12	9	11	291
Alliant (WP&L), Sheepskin	Edgerton	0	0	0	0	0	0
Dairyland Power Alma 1-5	Alma	3,724	3,445	4,350	7,284	9,386	5,638
Dairyland Power Genoa	Genoa	12,443	8,165	12,118	15,046	16,844	12,923
Madison Gas & Electric, Blount St.	Madison	3,999	6,923	6,795	7,181	6,494	6,278
MG&E, Fitchburg	Fitchburg	0	0	0	0	0	0
MG&E, Nine Springs	Madison	0	0	0	0	0	0
MG&E, Sycamore	Madison	0	0	0	0	0	0
WEPCO Germantown	Germantown	57	9	5	0	3	15
WEPCO Oak Creek	Oak Creek	28,236	22,832	17,882	10,569	13,294	18,562
WEPCO Point Beach	Two Rivers	1	0	0	0	0	0
WEPCO Port Washington	Port Wash.	11,376	15,573	12,778	9,820	9,062	11,722
WEPCO Valley	Milwaukee	16,865	15,835	15,060	16,218	11,537	15,103
WPSC Eagle River	Eagle River	0	0	0	0	1	0
WPSC Pulliam Plant	Green Bay	6,398	6,314	6,475	6,901	7,081	6,634
WPSC Weston 1&2	Weston	3,041	3,340	3,615	3,231	4,149	3,475
Subtotal - Pre-NSPS Major Utilities		122,938	120,754	112,838	113,771	116,593	117,379
NSPS Major Utilities							
Alliant (WP&L), Columbia 2	Portage	17,038	13,270	14,535	13,489	14,554	14,577
Alliant (WP&L), Edgewater 5	Sheboygan	10,970	8,744	9,235	9,203	10,039	9,638
Dairyland Power J.P. Madgett	Alma	5,456	5,376	4,980	7,489	5,777	5,816
WEPCO Pleasant Prairie	Kenosha	30,031	28,725	28,411	27,972	30,334	29,095
WPSC	Peshigo	3	0	2	1	1	1
WPSC Weston 3	Weston	8,372	8,358	8,806	8,562	8,948	8,609
Subtotal - NSPS Major Utilities		71,870	64,473	65,969	66,715	69,653	67,736
Total - Major Utilities		194,808	185,227	178,807	180,486	186,246	185,115

... (cont'd) Appendix A : Historical Listing of Sulfur Dioxide Emissions Arranged by Facility for 1999-2003

Facility Name	Location	SO <sub>2</sub> Emissions					Five Year Average (1999-2003)
		Year					
		1999	2000	2001	2002	2003	
Minor Utilities							
Manitowoc Public Utilities	Manitowoc	2,770	3,282	3,052	3,750	3,304	3,232
Subtotal - Minor Utilities		2,770	3,282	3,052	3,750	3,304	3,232
Paper Mills							
Appleton Coated, LLC <sup>1</sup>	Combined Locks	1,016	1,079	1,081	825	1,130	1,026
Domtar A. W. Corporation-Nekoosa Mill <sup>2</sup>	Nekoosa	3,510	3,121	3,196	4,351	4,238	3,683
Domtar A. W. Corporation-Port Edwards Mill <sup>3</sup>	Port Edwards	4,495	3,931	4,008	2,816	2,392	3,528
Stora Enso N. America-Biron Mill	Biron	5,378	5,681	5,353	5,781	5,519	5,542
Stora Enso N. America-Kimberly Mill <sup>4</sup>	Kimberly	1,566	1,656	1,748	1,866	2,020	1,771
Stora Enso N. America-Niagara Mill	Niagara	2,446	2,081	1,822	2,040	1,964	2,071
Stora Enso N. Am.-WI Rapids Pulp Mill	Wisc. Rapids	1,346	1,259	1,245	1,248	1,520	1,324
Fort James Operating Company	Green Bay	18,783	16,782	12,380	13,470	14,124	15,108
International Paper	Kaukauna	6,982	8,237	8,266	8,253	8,740	8,096
Procter & Gamble Paper Products Company <sup>*</sup>	Green Bay	4	536	1,868	2,011	1,733	1,230
Packaging Corporation of America <sup>5</sup>	Tomahawk	6,961	6,250	6,922	7,381	6,596	6,822
Mosinee Paper Corp.	Mosinee	1,253	1,268	1,198	1,422	1,567	1,342
Wausau-Mosinee Paper Co.-Rhinelander	Rhinelander	2,981	2,915	2,410	2,295	2,254	2,571
Subtotal - Paper Mills		56,721	54,796	51,497	53,759	53,797	54,114
Other Large Sources							
Murphy Oil USA, Inc.	Superior	2,039	1,809	2,140	1,659	1,021	1,734
University of Wisconsin - Charter	Madison	1,827	1,911	1,688	1,347	1,849	1,724
Subtotal - Other Large Source Facilities		3,866	3,720	3,828	3,006	2,870	3,458
Total - Large Sources		63,357	61,798	58,377	60,515	59,971	60,803

\* Facility added to Large Source list

1. Previously Combined Locks Energy Center, LLC
2. Previously Nekoosa Papers, Inc.
3. Previously Nekoosa Papers, Inc.
4. Previously Inter Lake Papers
5. Previously Tenneco Packaging, Inc.

**Appendix B: Historical Listing of Nitrogen Oxides Emissions Arranged by Facility for 1996-2003**

Facility Name	Location	NO <sub>x</sub> Emissions (tons)				
		YEAR				
		1999	2000	2001	2002	2003
Pre-NSPS Major Utilities						
Alliant (WP&L), Blackhawk	Beloit	34	36	38	59	50
Alliant (WP&L), Columbia 1	Portage	7,096	7,981	7,808	4,062	2,996
Alliant (WP&L), Edgewater 3&4	Sheboygan	11,575	12,817	9,994	5,727	5,421
Alliant (WP&L), Nelson Dewey	Cassville	5,000	5,413	4,787	5,167	4,281
Alliant (WP&L), Rock River	Beloit	1,694	419	415	560	741
Alliant (WP&L), Sheepskin	Edgerton	15	2	4	11	4
Dairyland Power, Alma 1-5	Alma	2,233	2,774	2,537	2,944	3,747
Dairyland Power, Genoa	Genoa	4,180	3,611	4,127	4,402	4,429
Madison Gas & Electric, Blount	Madison	1,811	1,480	1,379	1,401	1,460
Madison Gas & Electric, Fitchburg	Fitchburg	61	44	35	30	28
Madison Gas & Electric, Nine Springs	Madison	5	18	1	1	1
Madison Gas & Electric, Sycamore	Madison	37	1	13	15	17
WEPCO, Germantown	Germantown	248	264	174	133	108
WEPCO, Oak Creek	Oak Creek	16,973	19,786	17,967	16,583	5,016
WEPCO, Point Beach	Two Rivers	13	3	5	4	2
WEPCO, Port Washington	Port Washington	3,041	4,090	3,226	2,554	2,292
WEPCO, Valley	Milwaukee	6,649	7,259	7,410	7,668	3,093
WEPCO, Watertown	Watertown	504	359	141	128	93
WPSC, Eagle River	Eagle River	9	2	4	12	13
WPSC, Pulliam Plant	Green Bay	7,696	8,045	7,850	8,226	8,424
WPSC, Weston 1&2	Weston	2,893	3,262	3,412	3,141	3,746
Subtotal - Pre-NSPS Major Utilities		77,724	77,666	71,327	62,828	45,962
NSPS Major Utilities						
Alliant (WP&L), Columbia 2	Portage	8,140	6,774	8,115	6,904	7,198
Alliant (WP&L), Edgewater 5	Sheboygan	3,660	3,069	3,097	3,122	3,145
Dairyland Power, J.P. Madgett	Alma	5,219	4,845	5,081	4,304	4,484
WEPCO, Paris	Paris	574	447	230	252	185
WEPCO, Pleasant Prairie	Kenosha	18,952	18,452	18,430	17,311	16,950
WPSC	Peshtigo	181	164	150	135	168
WPSC, Weston 3	Weston	3,265	3,228	3,045	3,116	3,411
Subtotal - NSPS Major Utilities		39,990	36,978	38,148	35,144	35,541
Total - Major Utilities		117,714	114,645	109,475	97,972	81,503
Large Sources						
ANR Pipeline Co.	Marshfield	1,655	1,800	1,347	1,674	1,410
Cardinal FG	Menomonie	1,527	1,485	1,546	1,577	1,284
Cardinal FG	Portage	1,293	1,290	1,457	1,420	1,421
Domtar A.W. Corporation-Nekoosa Mill <sup>1</sup>	Nekoosa	1,381	1,263	1,307	1,448	1,386
Stora Enso North America-Biron Mill	Biron	2,207	2,328	2,122	2,202	2,142
Stora Enso NA-WI Rapids Pulp Mill	Wisconsin Rapids	2,026	2,002	1,894	1,851	1,875
Fort James Operating Co.	Green Bay	5,032	4,738	4,187	4,400	4,012
International Paper	Kaukauna	1,819	2,043	2,110	2,132	2,146
Xcel Energy Bay Front Generating Station <sup>3</sup>	Ashland	1,152	1,288	1,392	1,038	1,346
Packaging Corporation of America <sup>2</sup>	Tomahawk	1,560	1,615	1,834	1,849	1,591
Wausau-Mosinee Paper Co.-Rhinelander	Rhinelander	1,472	1,497	1,518	1,519	1,586
Total - Large Sources		21,124	21,348	20,714	21,110	20,199

1. Previously Nekoosa Papers, Inc.
2. Previously Tenneco Packaging, Inc.
3. Previously Northern States Power Co.

**Appendix C: 2003 Sulfur Dioxide Emissions Rates for Major Utilities  
and One Large, State-Owned Source**

**Dairyland Power Cooperative**

Unit Name	Heat Input (MMBtu)	Tons of SO <sub>2</sub>
Alma 1	1,205,112	1,072
Alma 2	1,166,959	1,039
Alma 3	1,275,403	1,135
Alma 4	2,918,997	2,595
Alma 5	3,988,110	3,545
J.P. Madgett	26,385,192	5,777
Genoa 3	21,088,868	16,844
Dairyland Totals	58,028,641	32,007

**lbs SO<sub>2</sub>/MMBtu 1.10**

**Alliant Energy Corporation (WP&L)**

Unit Name	Heat Input (MMBtu)	Tons of SO <sub>2</sub>
Blackhawk 3	192,090	0
Blackhawk 4	165,500	0
Columbia 1	20,580,550	7,317
Columbia 2	18,388,929	6,788
Edgewater 3	4,663,135	1,508
Edgewater 4	14,798,223	4,671
Edgewater 5	23,004,791	8,325
Nelson Dewey 1	6,907,672	6,994
Nelson Dewey 2	7,635,137	7,560
Rock River 1	1,980,468	6
Rock River 2	1,804,781	4
WP & L Totals	100,121,276	43,175

**lbs SO<sub>2</sub>/MMBtu 0.86**

**Wisconsin Public Service Corporation**

Unit Name	Heat Input (MMBtu)	Tons of SO <sub>2</sub>
Pulliam 8	10,797,335	2,269
Pulliam 7	5,787,712	1,271
Pulliam 5 & 6	11,050,517	2,536
Pulliam 3 & 4	4,507,752	1,005
Weston 3	27,560,285	8,948
Weston 2	8,371,376	2,533
Weston 1	5,166,937	1,616
Columbia 2	12,533,437	4,627
Columbia 1	13,749,565	4,887
Edgewater 4	7,089,461	2,242
WPSC Totals	106,614,377	31,934

**lbs SO<sub>2</sub>/MMBtu 0.60**

**Madison Gas & Electric Company**

Unit Name	Heat Input (MMBtu)	Tons of SO <sub>2</sub>
Columbia 1	9,712,749	3,453
Columbia 2	8,492,641	3,134
Blount 1-6 and 11	361,959	0
Blount 7	1,189,398	1,380
Blount 8	2,644,013	2,645
Blount 9	2,042,288	2,368
MG & E Totals	24,443,048	12,980

**lbs SO<sub>2</sub>/MMBtu 1.06**

**Wisconsin Electric Power Company**

Unit Name	Heat Input (MMBtu)	Tons of SO <sub>2</sub>
Edgewater 5	5,518,214	1,714
Milwaukee County	1,419,522	938
Oak Creek 5	13,566,241	2,672
Oak Creek 6	12,835,840	2,528
Oak Creek 7	15,643,036	3,081
Oak Creek 8	16,022,072	3,156
Pleasant Prairie 1	40,190,584	14,067
Pleasant Prairie 2	43,643,692	15,275
Port Washington 1	3,557,282	2,763
Port Washington 2	2,389,949	2,554
Port Washington 3	3,508,959	3,749
Port Washington 4	0	0
Port Washington 5	0	0
Valley 1	9,086,757	5,885
Valley 2	8,338,589	5,651
WEPCO Totals	175,720,735	64,034

**lbs SO<sub>2</sub>/MMBtu 0.73**

**University of Wisconsin-Madison (Charter Street)**

Unit Name***	Heat Input (MMBtu)	Tons of SO <sub>2</sub>
B21	544,777	278
B22	755,452	386
B23	605,491	309
B24	1,772,365	875
B25	345,790	0
UW-Charter Street Totals	4,023,876	1,848

**lbs SO<sub>2</sub>/MMBtu 0.92**

***Legend***

- \* Includes an additional 22% SO<sub>2</sub> removal per Permit 90-POY-037
- \*\* Includes an additional 13% SO<sub>2</sub> removal per Permit 90-POY-037
- \*\*\* These unit names are specified in the Air Emissions Inventory File

NOTE: This appendix does not include emissions from WEPCO Germantown & Point Beach, and WPSC Eagle River & Peshtigo.